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(54) **A method of and apparatus for separating articles conveyed by a conveyor system.**

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Description

The present invention relates to a method of and apparatus for separating articles conveyed on a conveyor system into a single, spaced queue. That is to say, articles forming randomly occurring and haphazardly orientated groups of articles on the conveyor system are separated from each other along the length of the conveyor system.

Conveyor systems are widely used to convey articles from one or more collection points to one or more destinations. DE-A-3 214910, for example, discloses a conveyor system with an intermittent drive for transferring articles from a storage conveyor to a feed conveyor. The articles conveyed by a conveyor system may include parcels, components, luggage, etc. It is not unusual for these articles to arrive at the conveyor system in randomly occurring and hapharzdly orientated groups. Since this prevents, or at the very least makes difficult, further handling of the articles, it is desirable to provide a system for separating the articles forming each group from each other along the length of the conveyor system. Consider for example a conveyor system carrying items of luggage from a plurality of check-in points to a plurality of aircraft loading bays.

Within an airport terminal luggage is usually handed in at a check-in point where it is labelled with the intended flight and then passed onto a conveyor system which carries it away to the airports luggage handling facility. It is not unusual for a plurality of check-in points to share a common conveyor system and this means that luggage intended for a number of different flights may be loaded onto the conveyor system together and in quite random and haphazard fashion. Each item of luggage conveyed on the conveyor system must be sorted according to its intended flight and this is usually carried out manually, either as the luggage passes along the conveyor system or when it reaches the end of the conveyor system. In either case, it will be readily appreciated that manual sorting of luggage is both time consuming and costly. Furthermore, it is not unknown for luggage to be misdirected because of the flight labels carried by each item of luggage being mis-read by the baggage handlers. Finally, extensive manual handling of the luggage introduces the possibility of luggage being opened and interferred with.

In order to avoid or, at least, minimise manual handling of luggage, luggage handling systems have been developed which sort the luggage according to their intended flight by reading a machine readable label attached to each item of luggage at the check-in points. According to the intended flight indicated by the label each item of luggage is selectively diverted from the conveyor system to an appropriate collection point. Indeed, it is possible for each item of luggage to be loaded directly into the hold of the intended flight. These luggage handling systems are quick and efficient in operation, but rely on the machine readable label carried by each item of luggage being properly presented to a label reading device. Obviously, where items of luggage are grouped together on the conveyor system the labels can be obscured, and even where the labels are readable it may not be possible to selectively divert a particular item away from the group because other items of luggage lie in its path off the conveyor system. As a consequence, it is desirable to separate from each other the items of luggage on the conveyor system. Gating systems can be used which only allow one item of luggage at a time to pass. However, these are not always reliable because jams of luggage can occur in front of the gate as several items of luggage arrive together. As a consequence, it is not unusual to find some manual sorting of the luggage taking place to ensure that each item of luggage is presented separately to the label reading device.

It is an object of the present invention to provide a method of and apparatus for separating articles conveyed on a conveyor system from each other, thereby forming a single spaced queue along the length of the conveyor system. It is another object of the present invention to provide a conveyor system comprising apparatus for separating articles conveyed on the conveyor system from each other, thereby forming a single, spaced queue along the length of the conveyor system.

According to a first aspect of the present invention there is provided a method for separating the leading article from a group of haphazardly presented and randomly sized articles being conveyed by a first independently operable upstream conveyor towards a second independently operable downstream conveyor, in which the first conveyor is stopped or reduced in speed relative to the second conveyor after all, or a substantial part of the leading article has passed onto the second conveyor, thereby introducing a speed differential between the leading article and the rest of the group and resulting in the leading article being drawn away from the rest of the group characterised in that:

a) where the trailing edge of the leading article is determined to overlap with the leading edge of the rest of the group the distance between the leading edge of the leading article and the leading edge of the rest of the group is determined and this distance is compared with a first predetermined measure of length, substantially equal to half the maximum expected length of a single article, and the first conveyor is stopped

or reduced in speed relative to the second conveyor only when the leading edge of the leading article has travelled forward beyond the transition point between the first and second conveyors by a distance which is at least equal to said first predetermined measure of length; and

b) where there is no discernible overlap between the trailing edge of the leading article and the leading edge of the rest of the group, and the length of the group of articles is determined to exceed a second predetermined measure of length, equal to the maximum expected length of a single article, the first conveyor is stopped or reduced in speed relative to the second conveyor when the leading edge of the group has travelled forward beyond the transition point between the first and second conveyors by a distance which is equal to said second predetermined measure of length.

After a predetermined period of time, corresponding to the minimum distance required between the leading article and the rest of the group has elapsed, the first conveyor may be returned to its normal operating speed relative to the second. Alternatively, the first conveyor may be returned to its normal operating speed relative to the second after the trailing edge of the leading article has passed article sensing means positioned downstream of the transition point between the first and second conveyors.

Conveniently, the length of a group of articles is determined by scanning the first conveyor widthwise at a point along its path to detect each leading and trailing edge to pass the point, and measuring the length of time which elapses between the detection Of each pair of leading and trailing edges. This measure of time corresponds to the length of the group. Preferably, in determining the overall distance between the leading and trailing edges of a group of articles any gap which occurs between the leading articles and the rest of the group, thereby giving rise to a further pair of leading and trailing edges, is ignored unless the length of the gap exceeds the minimum distance required to separate the leading article from the rest of the group. This ensures that where the leading article is separated from the rest of the group, but not by the required distance, article separation takes place. Preferably, the point along the path of the first conveyor at which it is scanned lies at, or immediately adjacent to the transition point between the first and second conveyors. In this position all, or a substantial part of the leading article amongst a group of articles will have passed onto the second conveyor by the time the presence of a leading article has been indicated and article separation can be carried out by stopping or reducing speed of the first conveyor relative to the second to ensure that the leading article is separated from the rest of the group by the required distance.

Where the trailing edge of the leading article overlaps with the leading edge of the rest of the group the distance between the leading edge of the leading article and the leading edge of the rest of the group is determined and this distance is then compared with a predetermined measure of length. If the distance between the leading edges is less than the predetermined measure the first conveyor is not stopped or reduced in speed relative to the second to separate the leading article from the rest of the group until the leading edge of the leading article has travelled said predetermined measure beyond the transition point between the first and second conveyors. If, on the other hand, the distance between the leading edges is greater than the predetermined measure the first conveyor is stopped or reduced in speed relative to the second immediately the leading edge of the rest of the group reaches the transition point. Thus, it is possible to ensure that enough of the leading article will always have passed onto the second conveyor to ensure that it is drawn away from the rest of the group, even when the trailing edge of the leading article overlaps with the leading edge of the rest of the group. The said predetermined measure of length is equal to at least half the maximum expected length of a single article. Conveniently, the distance between the leading edges is determined by measuring the period of time which elapses between the leading edges being sensed by article sensing means.

According to a second aspect of the present invention there is provided a first distance determining means which determines the distance between the leading edge of a leading article and the leading edge of the rest of the group of articles when the leading edge of the rest of the group of articles overlaps with the trailing edge of the leading article, associated with first comparator means for comparing the said distance with a first predetermined measure of length substantially equal to half the maximum expected length of a single article, and a second distance determining means determines the distance between the leading edge and trailing edge of a single article or group of articles being conveyed along the first conveyor, associated with second comparator means for comparing the said distance with a second predetermined measure of length equal to the maximum expected length of a single article, and that the control means operates to stop or reduce the speed of the first conveyor relative to the second conveyor:

a) when the leading edge of a leading article, the trailing edge of which overlaps with the leading edge of the rest of the group, has trav-

elled forward beyond the transition point between the first and second conveyors by a distance which is at least equal to said first predetermined measure of length as determined by the first distance determining means; and,

b) when there is no discernible overlap (as in (a) above) when the leading edge of a group of articles has travelled forward beyond the transition point between the first and second conveyors by a distance which is equal to said second predetermined measure of length as determined by the second distance determining means.

Preferably, the first distance determining means comprises at least two article sensors positioned side by side across the width of the apparatus, and a timing device controlled by the outputs of the said at least two article sensors to determine the length of time to elapse between one of the article sensors, detecting an article and the other article sensor detecting an article.

Preferably, the second distance determining means comprises an article sensor scanning the width of the first conveyor, and a timing device for measuring the length of time to elapse between detection of the leading edge and the trailing edge of a single article or group of articles passing the article sensor. Since the article sensing means are responsive to the leading edge of an article, this measured length of time corresponds to the distance between the leading edge of the leading article and the leading edge of the rest of the group. The actual number of article sensing means provided side by side across the width of the apparatus depends, of course, on the width of the apparatus.

Preferably, the article sensors each comprise a photoelectric cell positioned opposite a light source. As an article passes between the two the incident light on the photoelectric cell is interrupted, thereby causing a change in output.

Advantageously, the apparatus further comprises a third independently operable conveyor which either conveys articles to the first conveyor or conveys articles from the second conveyor, the direction of travel of which is transverse to that of the first and second conveyors. As two or more articles lying side by side across the path of the apparatus make the transition from either the third conveyor to the first conveyor or from the second conveyor to the third conveyor the distance between their respective leading edges is increased. In this respect, the distance travelled by an article towards the outside edge of the apparatus is greater than that travelled by an article on the inside edge of the apparatus. Conveniently, the third conveyor forms a right angle with either the first conveyor or the second conveyor.

An embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Fig. 1 shows a schematic partial view of a conveyor system comprising an article separator embodying the present invention;

Figs. 2 (a) to 2 (f) illustrate schematically the three basic configurations that articles can adopt on a conveyor system; and

Figs. 3(a) to 3(c) show schematically the operation of the article separator of Fig. 1 which each of the three basic configurations illustrated in Figs. 2(a) to 2(f).

Referring to Fig. 1 of the accompanying drawings there is shown a conveyor system comprising an article separator embodying the present invention. The article separator itself may be said to comprise that part of the conveyor system between conveyor belts 1 and 2 which are themselves intended to convey articles to and from the article separator. In this respect, the direction of travel of articles conveyed by the conveyor system is indicated by arrows A and articles to be separated are first presented to the article separator from conveyor belt 1. After passing through the article separator the articles are separated from each other and as they are carried away on conveyor belt 2 they form a single, spaced queue along its length.

Further handling of the articles will depend upon the application in which the conveyor system is used. For example, where the conveyor system forms part of a machine sorting system the individual destination of each article on conveyor belt 2 can be read from a machine readable label provided on the article and each article can then be selectively diverted from the conveyor belt 2, or subsequent conveyor belts, to a particular destination, collection point or the like.

The article separator itself comprises a plurality of relatively short conveyor belts of conventional design and construction, each of which is independently driven by drive means (not shown) in the direction of arrows A. Conveyor belts 3 and 4 form a right angle with conveyor belts 5 and 6. As a consequence of this, articles arriving at conveyor belt 5 from conveyor belt 4 will join conveyor belt 5 at different points along its longitudinal length, depending upon the respective positions of each article across the width of conveyor belt 4. The purpose of this arrangement will be described in detail hereinbelow.

Associated with each conveyor belt 1, 3, 4, 5 and 6 is a photocell device 7, 8, 9, 10 and 11, respectively, each of which is positioned at or towards the leading edge of the conveyor belt with which it is associated. Each photocell device scans the width of the conveyor belt with which it is associated to detect the arrival of the leading edge

of an article. Conveyor belt 4 is also provided with a further photocell device 12 which scans it obliquely and acts as a differential re-start device for conveyor belt 3, as will be explained in detail hereinbelow. Between conveyor belts 3 and 4 and conveyor belts 6 and 2 there is provided a pair of overhead photocell devices 13 and 14, and 15 and 16, respectively which are arranged side by side across the width of the conveyor belts. The overhead photocell devices comprising each pair, each monitor a respective half of the transition point between the conveyor belts for the arrival of the leading edge of an article. Photocell devices 13 and 15 monitor the inner half of the conveyor belts, and photocell devices 14 and 16 monitor the outer half of the conveyor belts.

The photocell devices 7 to 16 are of conventional design and may conveniently comprise a photoelectric cell and a source of light positioned opposite each other across the region to be monitored. It will be appreciated that as the leading of an article passes between the photoelectric cell and its light source, the light source is interrupted and the output of the photoelectric cell changes. Though not shown, the output of each photocell device 7 to 16 is connected to a central controller and this, in turn, controls the drive means for each conveyor belt 1 to 6, as will be described in detail hereinbelow.

Referring now to Figs. 2(a) to 2(f) there are illustrated schematically the three basic positions which articles on a conveyor system may adopt relative to one another. For simplicity's sake each basic position is demonstrated by pairs of articles. However, it should be appreciated that greater numbers may combine together to form a group and the articles in this group may take up any combination of these three basic positions with respect to one another. The only position not shown in these figures is that where one article lies on top of another. The reason for this is that the articles have been levelled off before reaching the article separator by means of a bar (not shown) which lies upstream of the article separator and across the path of the conveyor system. The use of a bar to level off articles is quite conventional and is, in fact, necessary because articles lying on top of each other are unstable.

Figs. 2(a) and (b) shod several pairs of articles and in each pair one article 21 is positioned immediately behind the other article 22 so that they are effectively head to tail along the length of the belt. As shown the articles 21 and 22 may be actually touching each other or they may be spaced slightly apart. Of course, where the distance between a spaced pair of articles meets a predetermined minimum then separate leading edges can be discerned for each article by the article separator and no further separation is required. However, where the spacing is less than this predetermined minimum the gap between the two articles is ignored by the article separator and article separation is carried out as will be described hereinbelow. As illustrated in Fig. 2(b) the articles 21 and 22 may adopt a wide variety of positions with respect to each other without departing from the basic position in which the trailing edge of the leading article 22 lies in front of the leading edge of the trailing article 21, though not by sufficient distance for the article 21 and 22 to be considered separate.

Figs. 2(c) and 2(d) show a plurality of pairs of articles in each of which one article 23 leads the other article 24 in a longitudinal direction. However, this basic position differs from that of Figs. 2(a) and 2(b) in that the articles 23 and 24 lie side by side across the width of the conveyor belt in such a way that the trailing edge of leading article 23 overlaps with the leading edge of trailing article 24. The leading article may lie on either the right or left hand side of the conveyor belt and it may or not be touching the trailing article 24. In this basic position it will be appreciated only the leading edge 25 of the leading article 23 can be clearly identified from a point to the side of the conveyor belt and it is, of course, impossible to determine from such a view whether it is the leading edge of an article on the right or left hand side of the conveyor belt. However, by viewing the articles 23 and 24 from above the conveyor belt it is possible to descern which of the two articles is leading the other and whether it lies on the left or right hand side of the conveyor belt. In other words, viewed from overhead both articles 23 and 24 have separately identifiable leading edges 25 and 26 which is not the case for the articles 21 and 22 shown in Figs. 2(a) and 2(b), and it is this feature which distinguishes one position from the other.

Figs. 2(e) and (f) show two articles 27 and 28 lying alongside one another across the width of the conveyor belt with no discernable distance between their respective leading edges 29 and 30. Where two or more articles adopt this position it is not possible to distinguish them from a single article when viewed from the side of the conveyor belt or from above the conveyor belt.

Operation of the article separator will now be described with reference to Figs. 3(a) to 3(c) of the accompanying drawings, each of which illustrates and describes the manner in which the article separator separates articles arranged in each of the three basic positions described with reference to Figs. 2(a) to 2(f).

Referring now to Fig. 3(a) operation of the article separator to separate articles arranged in the basic article position shown in Fig. 2(a) will be described.

The first conveyor belt in the article separator, that is conveyor belt 3, runs at the same speed as conveyor 1 and therefore there is no change in the relative positions of articles 21 and 22 as they pass from one to the other. As the leading edge of article 22 reaches the junction between conveyor belts 3 and 4 it passes between the photoelectric cell and the light source comprising photocell device 8. This causes a timing device within the central controller (not shown) to begin counting. The timing device is set to ignore any brief change in the output of the photocell device 8, corresponding to a small gap between the two articles 21 and 22, and only if the change is of sufficient duration to signify that the articles 21 and 22 are separated by the required amount will the timing device cease counting to begin again when the leading edge of article 21 reaches it.

If the period of time for which the photocell device 8 is interrupted exceeds a predetermined maximum corresponding to the expected maximum length of a single article plus the minimum accepted article separation between adjacent articles then the central controller turns off or reduces the speed of the drive to conveyor belt 3. Of course, by this time the leading article 22 will have passed fully onto conveyor belt 4 which as it continues to run will carry it forward. However, the lagging article 21 will still be wholly or partially on conveyor belt 3 and will have stopped or slowed down with it. In this way, a gap is developed between the two articles 21 and 22. The size of this gap is determined by the period for which the drive to conveyor belt 3 is turned off or reduced and this period may be preset by a timing device within the central controller, or, alternatively, by the clearance of the trailing edge of article 22 at photocell device 12.

As shown the photocell device 12 scans obliquely across the width of conveyor belt 4 so that a differential restart for conveyor belt 3 is obtained according to the relative position of the article 22 across the width of conveyor belt 4. This differential restart is advantageous in as much as it ensures that a larger gap develops behind an article which has to negotiate the right angle transfer between conveyor belts 4 and 5 from the outside edge of the article separator. As will be readily understood an article making the transfer from the inside edge of the article separator travels a much shorter distance than an article making the transfer from the outside edge and without the differential restart of conveyor belt 3 there would be a tendency for articles on the inside edge to catch up with articles on the outside edge.

As articles 21 and 22 negotiate the remainder of the article separator there is little or no change in their relative positions unless, as indicated above, one lies on the inside edge and the other on the outside edge or a speed differential exists between adjacent pairs of conveyor belts. In any event the article separator operates to ensure that the gap between them is increased rather than decreased.

Should conveyor belt 3 or indeed any of the subsequent conveyor belts be stopped or slowed down to allow a leading article to be drawn away from a lagging article there will of course be a pile up behind the stopped conveyor belt if the belt behind it is not stopped as well. For this reason, photocell devices 7, 8, 9, 10 and 11 all act as queue controllers which ensure that the drive to the conveyor belt with which each is associated is turned off immediately an article arrives at it and the drive to the conveyor belt in front of it has been turned off.

Referring now to Fig. 3(b) operation of the article separator to separate articles arranged in the basic article position shown in Fig. 2(c) will be described.

As articles 23 and 24 pass from conveyor belt 1 to conveyor belt 3 there is, again, no change in their relative positions. Moreover, as the leading edge of article 23 reaches photocell device 8 the overall length of the two articles 23 and 24 together is determined by the timing circuit within the central controller so that if this exceeds the maximum expected length of a single article, article separation takes place as previously described with reference to Fig. 3(a). However, as the leading edge of article 23 passes across the junction between conveyor belts 3 and 4 one or other of the two overhead photocell devices 13 and 14 is interrupted and this provides an indication as to whether it is on the inside half of the article separator or the outside half of the article separator.

If, as shown in Fig. 3(b), the leading article 23 is on the inside half of the article separator photocell 13 is interrupted first and this starts two timing devices within the central controller. The first of these timing devices counts the time taken for the leading edge of the lagging article 24 to reach photocell device 14 and determines whether the two articles 23 and 24 are arranged in the basic article position shown in Fig. 2(c) or in Fig. 2(e). Should the leading edge of the lagging article 24 reach photocell device 14 within a predetermined period set by the first timing device the basic article position shown in Fig. 2(e) is indicated. Otherwise, the basic article position shown in Fig. 2(c) is indicated. The second timer device also counts the time taken for the leading edge of the lagging article 24 to reach the photocell device 14, but is preset with a predetermined period equivalent to the time taken for half the maximum expected length of a single article.

If the leading edge of the lagging article 24 should be detected by photocell device 14 within the predetermined period set by the second timer then upon completion of this predetermined period the drive to conveyor belt 3 is stopped or reduced. If, however, the leading edge of the lagging article 24 should not be detected until after the predetermined period set by the second timer has run out, but before the leading article 23 has cleared photocell device 13 the drive to conveyor belt 3 is stopped or reduced immediately.

It will be seen that the drive to conveyor belt 3 is stopped or reduced only after the leading article 23 is at least half way across the junction between conveyor belts 3 and 4. This is sufficient to ensure that the leading article 23 continues to be drawn forward by conveyor belt 4 whilst the lagging article 24 is stopped or slowed down with conveyor belt 3. Once the leading article 23 is far enough ahead of the lagging article 24 conveyor belt 3 can be restarted or run up to its normal operating speed in the same manner as that previously described with reference to Fig. 3(a).

After passing from conveyor belt 3 to conveyor belt 4 there is little or no change in their relative positions of articles 23 and 24 unless, as previously described above, one lies on the inside edge and the other on the outside edge or a speed differential exists between adjacent pairs of conveyor belts. In any event, the article separator operates to ensure that the gap between them is increased rather than decreased.

Referring now to Fig. 3(c) operation of the article separator to separate articles arranged in the basic article position shown in Fig. 2(e) will be described.

As will be appreciated from the explanation given hereinabove with reference to Fig. 3(b) where the leading edges of two articles 27 and 28 are effectively neck and neck there will be no change in their relative positions as they pass from conveyor belt 1 to conveyor belt 3, or from conveyor belt 3 to conveyor belt 4. However, when the two articles 27 and 28 come to negotiate the transition between conveyor belts 4 and 5 article 27 on the inside half of the article separator will move forward, ahead of article 28 on the outside half of the article separator because of the shorter path which it takes. Depending on the length of the two articles 27 and 28, and the distance by which they are spaced across the width of conveyor belt 4 the transition between conveyor belts 4 and 5 will change the basic article configuration the articles take from that shown in Fig. 2(e) to either that shown in Fig. 2(a) or more probably that shown in Fig. 2(c).

As the articles 27 and 28 move forward from conveyor belt 5 to conveyor belt 6 they are separated fully from each other in the same manner as previously described hereinabove with reference to Fig. 3(a) or Fig. 3(b).

Although the operation of the article separator described hereinabove has only been illustrated and described with reference to pairs of articles it will be readily appreciated that the mode of operation also applies to larger groups of articles in exactly the same way. In this respect, each group of articles is effectively treated as a single pair of articles comprising a leading and a lagging article. Once the leading article has been separated from the lagging article the lagging article becomes the leading article and the next article becomes the lagging article. In the event that three or more articles should arrive at the article separator neck and neck the right angled transition between conveyor belts ensures that a distinguishable lead and lag is introduced between each adjacent pair and thereafter separation proceeds as before.

The article separator is particularly suited for use with a machine sorting system in separating items of luggage on a conveyor system between a plurality of check-in points and a plurality of specific destinations. However, it may equally well be applied to conveyor systems carrying parcels, components or the like, and it can be used with or without a machine sorting system.

Claims

1. A method for separating the leading article from a group of haphazardly presented and randomly sized articles being conveyed by a first independently operable upstream conveyor towards a second independently operable downstream conveyor, in which the first conveyor (3) is stopped or reduced in speed relative to the second conveyor (4) after all, or a substantial part of the leading article has passed onto the second conveyor (4), thereby introducing a speed differential between the leading article and the rest of the group and resulting in the leading article being drawn away from the rest of the group characterised in that:

   a) where the trailing edge of the leading article is determined to overlap with the leading edge of the rest of the group the distance between the leading edge of the leading article and the leading edge of the rest of the group is determined and this distance is compared with a first predetermined measure of length, substantially equal to half the maximum expected length of a single article, and the first conveyor (3) is stopped or reduced in speed relative to the second conveyor (4) only when the

leading edge of the leading article has travelled forward beyond the transition point between the first and second conveyors (3, 4) by a distance which is at least equal to said first predetermined measure of length; and

b) where there is no discernible overlap between the trailing edge of the leading article and the leading edge of the rest of the group, and the length of the group of articles is determined to exceed a second predetermined measure of length equal to the maximum expected length of a single article, the first conveyor (3) is stopped or reduced in speed relative to the second conveyor (4) when the leading edge of the group has travelled forward beyond the transition point between the first and second conveyors by a distance which is equal to said second predetermined measure of length.

2. A method according to claim 1, characterised in that after a predetermined period of time corresponding to the minimum distance required between the leading article and the rest of the group has elapsed, the first conveyor (3) is returned to its normal operating speed relative to the second conveyor (4).

3. A method according to claim 1, characterised in that the first conveyor (3) is returned to its normal operating speed relative to the second conveyor (4) after the trailing edge of the leading article has passed article sensing means (12) positioned downstream of the transition point between the first and second conveyors (3, 4).

4. A method according to claim 3, characterised in that the article sensing means (12) scans the second conveyor (4) obliquely, thereby giving rise to a differential restart for the first conveyor (3) according to the position of the leading article across the width of the second conveyor (4).

5. A method according to any preceding claim, characterised in that the length of the group of articles is determined by scanning the first conveyor (3) width-wise at a point along its path to detect each leading and trailing edge to pass the point, and measuring the length of time which elapses between the detection of each pair of leading and trailing edges.

6. A method according to claim 5, characterised in that any gap which occurs between the trailing edge of the leading article and the leading edge of the rest of the group, is ignored unless the length of the gap exceeds the minimum distance required to separate the leading article from the rest of the group.

7. A method according to claim 6, characterised in that the point along the path of the first conveyor (3) at which it is scanned lies at, or immediately adjacent to, the transition point between the first and second conveyors (3, 4).

8. A method according to any preceding claim, characterised in that when the distance between the leading edge of the leading article and the leading edge of the rest of the group is determined to be less than the first predetermined measure the first conveyor (3) is not stopped or reduced in speed relative to the second conveyor (4) until the leading edge of the leading article has travelled said first predetermined measure beyond the transition point between the first and second conveyors (3, 4).

9. A method according to any of claims 1 to 7, characterised in that when the distance between the leading edge of the leading article and the leading edge of the rest of the group is determined to be greater than the first predetermined measure the first conveyor (3) is stopped or reduced in speed relative to the second conveyor (4) immediately the leading edge of the rest of the group reaches the transition point between the first and second conveyors (3, 4).

10. A method according to any preceding claim, characterised in that the distance between the leading edge of the leading article and the leading edge of the rest of the group is determined by measuring the period of time which elapses between the leading edges being sensed by article sensing means (13, 14).

11. A method according to any preceding claim, characterised in that the leading edge of the leading article and the leading edge of the rest of the group are sensed at or immediately adjacent to the transition point between the first and second conveyors (3, 4).

12. A method according to any preceding claim, characterised in that a difference in distance is introduced between the leading edge of a first article lying level with the leading edge of a second article, by conveying the first and second articles to the said first independently op-

erable upstream conveyor (3) by means of a third independently operable conveyor, the direction of travel of which is transverse to that of the said first conveyor (3).

13. Apparatus for separating the leading article from a group of haphazardly presented and randomly sized articles being conveyed along a conveyor system, comprises a first independently operable upstream conveyor (3), a second independently operable downstream conveyor (4), means (8, 13, 14) for determining the distance between the leading and trailing edges of an article or group of articles and control means responsive to the output of the edge detecting means for controlling the operation of the first and second conveyors, characterised in that a first distance determining means (13, 14) determines the distance between the leading edge of a leading article and the leading edge of the rest of the group of articles when the leading edge of the rest of the group of articles overlaps with the trailing edge of the leading article, associated with first comparator means for comparing the said distance with a first predetermined measure of length substantially equal to half the maximum expected length of a single article, and a second distance determining means (8) determines the distance between the leading edge and the trailing edge of a single article or group of articles being conveyed along the first conveyor (3), associated with second comparator means for comparing the said distance with a second predetermined measure of length equal to the maximum expected length of a single article, and that the control means operates to stop or reduce the speed of the first conveyor (3) relative to the second conveyor (4):

a) when the leading edge of a leading article, the trailing edge of which overlaps with the leading edge of the rest of the group, has travelled forward beyond the transition point between the first and second conveyors by a distance which is at least equal to said first predetermined measure of length as determined by the first distance determining means (13, 14); and,

b) when there is no discernible overlap (as in (a) above) when the leading edge of a group of articles has travelled forward beyond the transition point between the first and second conveyors by a distance which is equal to said second predetermined measure of length as determined by the second distance determining means (8).

14. Apparatus according to claim 13, characterised in that the first distance determining means (13, 14) comprises at least two article sensors (13, 14) positioned side by side across the width of the apparatus, and a timing device controlled by the outputs of the said at least two article sensors (13, 14) to determine the length of time to elapse between one of the article sensors (13, 14) detecting an article and the other article sensor (13, 14) detecting an article.

15. Apparatus according to claim 13 or 14, characterised in that the second distance determining means (8) comprises an article sensor (8) scanning the width of the first conveyor (3), and a timing device for measuring the length of time to elapse between detection of the leading edge and the trailing edge of a single article or group of articles passing the article sensor (8).

16. Apparatus according to claim 15, characterised in that the timing device is set to ignore changes in the output of the article sensor (8) after the detection of a first leading edge, where these indicate the detection of a trailing edge and then a second leading edge which are not separated from each other by the minimum distance required to separate a leading article from the rest of the group.

17. Apparatus according to claims 14, 15 or 16, characterised in that the second distance determining means (8) is positioned at, or immediately adjacent to, the transition point between the first and second conveyors (3, 4).

18. Apparatus according to any one of claims 14 to 17, characterised in that the article sensors each comprise a photoelectric cell positioned opposite a light source.

19. Apparatus according to any one of claims 13 to 18, characterised in that the apparatus comprises a further independently operable conveyor which conveys articles to the first conveyor, the direction of travel of which is transverse to that of the first and second conveyors.

20. Apparatus according to claim 19, characterised in that the apparatus comprises yet a further independently operable conveyor which conveys articles from the second conveyor, the direction of travel of which is transverse to that of the first and second conveyors.

21. Apparatus according to any one of claims 13 to 20, characterised in that further article sensing means (12) is positioned downstream of the transition point between the first and second conveyors (3, 4), which article sensing means (12) controls the return to normal operating speed of the first conveyor (3).

22. Apparatus according to claim 21, characterised in that the article sensing means (12) scans obliquely across the width of the second conveyor (4), thereby giving rise to a differential restart of the first conveyor (3) according to the position of the article across the width of the second conveyor (4).

Patentansprüche

1. Verfahren zum Trennen des führenden Gegenstands aus einer Gruppe zufällig angeordneter Gegenstände willkürlicher Größe, die von einem ersten unabhängig betreibbaren Hin-Förderer zu einem zweiten unabhängig betreibbaren Rück-Förderer gefördert werden, bei dem der erste Förderer (3) angehalten oder in seiner Geschwindigkeit gegenüber dem zweiten Förderer (4) verringert wird, nachdem der vollständige führende Gegenstand oder ein wesentlicher Teil von ihm auf den zweiten Förderer (4) gelangt ist, wodurch ein Geschwindigkeitsdifferential zwischen dem führenden Gegenstand und dem Rest der Gruppe eingeführt wird, was dazu führt, daß der führende Gegenstand von dem Rest der Gruppe weggezogen wird, dadurch gekennzeichnet, daß:
   a) wo von der Hinterkante des führenden Gegenstands bestimmt wird, daß sie sich mit der Vorderkante des Rests der Gruppe überlappt, der Abstand zwischen der Vorderkante des führenden Gegenstands und der Vorderkante des Rests der Gruppe bestimmt wird und dieser Abstand mit einem ersten vorbestimmten Längenmaß verglichen wird, das der Hälfte der maximalen erwarteten Länge eines einzelnen Gegenstands im wesentlichen gleich ist, und der erste Förderer (3) angehalten oder in seiner Geschwindigkeit gegenüber dem zweiten Förderer (4) nur dann verringert wird, wenn die Vorderkante des führenden Gegenstands über den Übergangspunkt zwischen dem ersten und dem zweiten Förderer (3, 4) um einen Abstand vorwärts gewandert ist, der dem ersten vorbestimmten Längenmaß mindestens gleich ist; und
   b) für den Fall, wo es keine unterscheidbare Überlappung zwischen der Hinterkante des führenden Gegenstands und der Vorderkante des Rests der Gruppe gibt und von der Länge der Gruppe von Gegenständen bestimmt wird, daß diese ein zweites vorbestimmtes Längenmaß überschreitet, das der maximalen erwarteten Länge eines einzelnen Gegenstands gleich ist, der erste Förderer (3) angehalten oder in seiner Geschwindigkeit gegenüber dem zweiten Förderer (4) verringert wird, wenn die Vorderkante der Gruppe über den Übergangspunkt zwischen dem ersten und zweiten Förderer um einen Abstand vorwärts gewandert ist, der dem zweiten vorbestimmten Längenmaß gleich ist.

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß, nachdem eine vorbestimmte Zeitdauer entsprechend dem benötigten Minimalabstand zwischen dem führenden Gegenstand und dem Rest der Gruppe verstrichen ist, der erste Förderer (3) in seine normale Betriebsgeschwindigkeit gegenüber dem zweiten Förderer (4) zurückgeführt wird.

3. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß der erste Förderer (3) in seine normale Betriebsgeschwindigkeit gegenüber dem zweiten Förderer (4) zurückgeführt wird, nachdem die Hinterkante des führenden Gegenstands an Gegenstandssensormitteln (12) vorbei gelangt ist, die hinter dem Übergangspunkt zwischen dem ersten und zweiten Förderer (3, 4) positioniert sind.

4. Verfahren nach Anspruch 3, dadurch gekennzeichnet, daß die Gegenstandssensormittel (12) den zweiten Förderer (4) schräg abtasten und dadurch zu einem differentiellen Neustart für den ersten Förderer (3) führen, je nach der Position des führenden Gegenstands quer zur Breite des zweiten Förderers (4).

5. Verfahren nach einem vorhergehenden Anspruch, dadurch gekennzeichnet, daß die Länge der Gruppe von Gegenständen durch Abtasten des ersten Förderers (3) in Querrichtung an einem Punkt längs seines Wegs zur Feststellung des Vorbeigehens jeder Vorder- und Hinterkante an diesem Punkt und durch Messen der Zeitlänge bestimmt wird, die zwischen der Feststellung jedes Paares aus Vorder- und Hinterkante verstreicht.

6. Verfahren nach Anspruch 5, dadurch gekennzeichnet, daß eine zwischen der Hinterkante des führenden Gegenstands und der Vorderkante des Rests der Gruppe auftretende Lücke ignoriert wird, falls nicht die Länge der Lücke

den zum Trennen des führenden Gegenstands von dem Rest der Gruppe benötigten Minimalabstand überschreitet.

7. Verfahren nach Anspruch 6, dadurch gekennzeichnet, daß der Punkt längs des Weges des ersten Förderers (3), an dem er abgetastet wird, an oder unmittelbar benachbart zu dem Übergangspunkt zwischen dem ersten und dem zweiten Förderer (3, 4) liegt.

8. Verfahren nach einem vorhergehenden Anspruch, dadurch gekennzeichnet, daß, wenn von dem Abstand zwischen der Vorderkante des führenden Gegenstands und der Hinterkante des Rests der Gruppe festgestellt wird, daß er kleiner als das erste vorbestimmte Maß ist, der erste Förderer (3) nicht angehalten oder in seiner Geschwindigkeit gegenüber dem zweiten Förderer (4) verringert wird, bis die Vorderkante des führenden Gegenstands um das erste vorbestimmte Maß über den Übergangspunkt zwischen dem ersten und zweiten Förderer (3, 4) hinausgewandert ist.

9. Verfahren nach einem der Ansprüche 1 bis 7, dadurch gekennzeichnet, daß dann, wenn von dem Abstand zwischen der Vorderkante des führenden Gegenstands und der Vorderkante des Rests der Gruppe bestimmt wird, daß er größer als das erste vorbestimmte Maß ist, der erste Förderer (3) angehalten oder in seiner Geschwindigkeit gegenüber dem zweiten Förderer (4) reduziert wird, unmittelbar sobald die Vorderkante des Rests der Gruppe den Übergangspunkt zwischen dem ersten und zweiten Förderer (3, 4) erreicht.

10. Verfahren nach einem vorhergehenden Anspruch, dadurch gekennzeichnet, daß der Abstand zwischen der Vorderkante des führenden Gegenstands und der Vorderkante des Rests der Gruppe durch Messen der Zeitdauer bestimmt wird, die zwischen der Feststellung der Vorderkanten durch Gegenstandssensormittel (13, 14) verstreicht.

11. Verfahren nach einem vorhergehenden Anspruch, dadurch gekennzeichnet, daß die Vorderkante des führenden Gegenstands und die Vorderkante des Rests der Gruppe an oder unmittelbar benachbart zu dem Übergangspunkt zwischen dem ersten und zweiten Förderer (3, 4) abgefühlt wird.

12. Verfahren nach einem vorhergehenden Anspruch, dadurch gekennzeichnet, daß ein Abstandsunterschied zwischen der Vorderkante eines ersten Gegenstands, der auf gleicher Höhe mit der Vorderkante eines zweiten Gegenstands liegt, eingeführt wird, in dem der erste und zweite Gegenstand zu dem ersten unabhängig betreibbaren HinFörderer (3) mit Hilfe eines dritten unabhängig betreibbaren Förderers gefördert werden, dessen Bewegungsrichtung quer zu der des ersten Förderers (3) ist.

13. Vorrichtung zum Trennen des führenden Gegenstands von einer Gruppe von zufällig dargebotenen Gegenständen willkürlicher Größe, die längs eines Fördersystems gefördert werden, enthaltend einen ersten unabhängig betätigbaren Hin-Förderer (3), einen zweiten unabhängig betätigbaren Rückförderer (4), Mittel (8, 13, 14) zur Bestimmung des Abstands zwischen den Vorder- und Hinterkanten eines Gegenstandes oder einer Gruppe von Gegenständen sowie auf den Ausgang der Kantenfeststellmittel ansprechende Steuermittel zum Steuern des Betriebs des ersten und zweiten Förderers, dadurch gekennzeichnet, daß ein erstes Abstandsbestimmungsmittel (13, 14) den Abstand zwischen der Vorderkante eines führenden Gegenstands und der Vorderkante des Rests der Gruppe von Gegenständen bestimmt, wenn die Vorderkante des Rests der Gruppe von Gegenständen sich mit der Hinterkante des führenden Gegenstands überlappt, zugeordnet zu ersten Komparatormitteln zum Vergleichen dieses Abstands mit einem ersten vorbestimmten Längenmaß, das der Hälfte der maximalen erwarteten Länge eines einzelnen Gegenstandes im wesentlichen gleich ist, und daß ein zweites Abstandsbestimmungsmittel (8) den Abstand zwischen der Vorderkante und der Hinterkante eines einzelnen Gegenstands oder einer Gruppe von Gegenständen bestimmt, die längs des ersten Förderers (3) gefördert werden, zugeordnet zu zweiten Komparatormitteln zum Vergleichen dieses Abstands mit einem zweiten vorbestimmten Längenmaß, das der maximalen erwarteten Länge eines einzelnen Gegenstands gleich ist, und daß die Steuermittel zum Anhalten oder Geschwindigkeitsverringern des ersten Förderers (3) gegenüber dem zweiten Förderer (4) wirken:

a) wenn die Vorderkante eines führenden Gegenstands, dessen Hinterkante sich mit der Vorderkante des Rests der Gruppe überlappt, über den Übergangspunkt zwischen dem ersten und zweiten Förderer um einen Abstand vorwärts gewandert ist, der dem ersten vorbestimmten Längenmaß mindestens gleich ist, wie von dem ersten Ab-

standsbestimmungsmittel (13, 14) festgestellt; und

b) wenn es keine unterscheidbare Überlappung (wie in a) oben) gibt, wenn die Vorderkante einer Gruppe von Gegenständen über den Übergangspunkt zwischen dem ersten und zweiten Förderer um einen Abstand vorwärts gewandert ist, der dem zweiten vorbestimmten Längenmaß gleich ist, wie von den zweiten Abstandsbestimmungsmitteln (8) bestimmt.

14. Vorrichtung nach Anspruch 13, dadurch gekennzeichnet, daß die ersten Abstandsbestimmungsmittel (13, 14) mindestens zwei Gegenstandssensoren (13, 14) umfassen, die Seite an Seite quer zur Breite der Vorrichtung angeordnet sind, sowie ein von den Ausgängen dieser mindestens zwei Gegenstandssensoren (13, 14) gesteuertes Zeitgerät zur Bestimmung der Zeitdauer, die zwischen der Feststellung eines Gegenstands durch einen Gegenstandssensor (13, 14) und der Feststellung eines Gegenstands durch den anderen Gegenstandssensor (13, 14) abläuft.

15. Vorrichtung nach Anspruch 13 oder 14, dadurch gekennzeichnet, daß die zweiten Abstandsfeststellmittel (8) einen die Breite des ersten Förderers (3) abtastenden Gegenstandssensor (8) und ein Zeitgerät zur Messung der Zeitdauer enthält, die zwischen der Feststellung der Vorderkante und der Hinterkante eines einzelnen Gegenstands oder einer Gruppe von Gegenständen abläuft, die an dem Gegenstandssensor (8) vorbeigelangen.

16. Vorrichtung nach Anspruch 15, dadurch gekennzeichnet, daß das Zeitgerät so eingestellt ist, daß es Änderungen im Ausgang des Gegenstandssensors (8) nach der Feststellung einer ersten Vorderkante ignoriert, wenn diese die Feststellung einer Hinterkante und dann einer zweiten führenden Kante anzeigen, die voneinander nicht durch den zum Trennen eines führenden Gegenstands von dem Rest der Gruppe benötigten Minimalabstand getrennt sind.

17. Vorrichtung nach Anspruch 14, 15 oder 16, dadurch gekennzeichnet, daß die zweiten Abstandsfeststellmittel (8) an oder unmittelbar benachbart zu dem Übergangspunkt zwischen dem ersten und zweiten Förderer (3, 4) positioniert sind.

18. Vorrichtung nach einem der Ansprüche 14 bis 17, dadurch gekennzeichnet, daß die Gegenstandssensoren jeweils eine photoelektrische Zelle umfassen, die einer Lichtquelle gegenüberliegend positioniert ist.

19. Vorrichtung nach einem der Ansprüche 13 bis 18, dadurch gekennzeichnet, daß die Vorrichtung einen weiteren unabhängig betreibbaren Förderer umfaßt, der Gegenstände zu dem ersten Förderer fördert und dessen Bewegungsrichtung quer zu der des ersten und zweiten Förderers ist.

20. Vorrichtung nach Anspruch 19, dadurch gekennzeichnet, daß die Vorrichtung nochmals einen weiteren unabhängig betreibbaren Förderer umfaßt, der Gegenstände von dem zweiten Förderer fördert und dessen Bewegungsrichtung quer zu der des ersten und zweiten Förderers ist.

21. Vorrichtung nach einem der Ansprüche 13 bis 20, dadurch gekennzeichnet, daß weitere Gegenstandssensormittel (12) hinter dem Übergangspunkt zwischen dem ersten und zweiten Förderer (3, 4) angeordnet sind, die die Rückkehr des ersten Förderers (3) auf seine normale Betriebsgeschwindigkeit steuern.

22. Vorrichtung nach Anspruch 21, dadurch gekennzeichnet, daß die Gegenstandssensormittel (12) schräg über die Breite des zweiten Förderers (4) abtasten und zu einem differentiellen Neustart des ersten Förderers (3) entsprechend der Position des Gegenstands quer zur Breite des zweiten Förderers (4) führen.

Revendications

1. Une méthode pour séparer le premier article d'un groupe d'articles de taille aléatoire et présentés au hasard et qui est transporté par un premier transporteur amont pouvant fonctionner indépendamment vers un deuxième transporteur aval pouvant fonctionner indépendamment, méthode dans laquelle le premier transporteur (3) est arrêté ou ralenti par rapport au deuxième transporteur (4) après que tout, ou une partie substantielle, du premier article soit passé sur le deuxième transporteur (4), introduisant ainsi un différentiel de vitesse entre le premier article et le reste du groupe de sorte que le premier article soit emporté par rapport au reste du groupe, ladite méthode étant caractérisée en ce que :

a) dans le cas ou le bord avant du premier article est défini comme se chevauchant avec le bord avant du reste du groupe, la distance entre le bord avant du premier

article et le bord avant du reste du groupe est déterminée et cette distance est comparée à une première mesure prédéterminée de longueur, égale en substance à la moitié de la longueur maximale attendue pour un article unique, et le premier transporteur (3) est arrêté ou ralenti par rapport au deuxième transporteur (4) seulement quand le bord avant du premier article se sera avancé au delà du point de transition entre les premier et deuxième transporteurs (3, 4) d'une distance qui est au moins égale à ladite première mesure de longueur prédéterminée ; et,

b) dans le cas où il n'y a aucun chevauchement distinguable entre le bord avant du premier article et le bord avant du reste du groupe, et que la longueur du groupe d'articles est déterminée et dépasse une deuxième mesure prédéterminée de longueur égale a la longueur maximale attendue pour un article unique, le premier transporteur (3) est arrêté ou ralenti par rapport au deuxième transporteur (4) quand le bord avant du groupe se sera avancé au-delà du point de transition entre les premier et deuxième transporteurs d'une distance qui est égale à ladite deuxième mesure prédéterminée de longueur.

2. Une méthode selon la revendication 1, caractérisée en ce qu'après l'écoulement d'une période de temps prédéterminée correspondant à la distance minimale requise entre le premier article et le reste du groupe, le premier transporteur (3) retourne à sa vitesse normale de fonctionnement par rapport au deuxième transporteur (4).

3. Une méthode selon la revendication 1, caractérisée en ce que le premier transporteur (3) retourne à sa vitesse normale de fonctionnement par rapport au deuxième transporteur (4) après que le bord arrière du premier article a passé des moyens de détection d'articles (12) situés en aval du point de transition entre les premier et deuxième transporteurs (3, 4).

4. Une méthode selon la revendication 3 caractérisée en ce que les moyens de détection d'articles (12) balaient le deuxième transporteur (4) obliquement, provoquant ainsi un redémarrage différentiel du le premier transporteur (3) selon la position du premier article sur la largeur du deuxième transporteur (4).

5. Une méthode selon n'importe laquelle des revendications précédentes, caractérisée en ce que la longueur du groupe d'articles est déterminée en balayant le premier transporteur (3) dans le sens de la largeur en un point sur son chemin pour détecter chaque bord avant et arrière qui passe le point, et en mesurant la durée du temps qui s'écoule entre la détection de chaque paire de bord avant et arrière.

6. Une méthode selon la revendication 5, caractérisée en ce que tout écart qui se présente entre le bord arrière du premier article et le bord avant du reste du groupe est négligé sauf si la longueur de l'écart dépasse la distance minimale requise pour séparer le premier article du reste du groupe.

7. Une méthode selon la revendication 6, caractérisée en ce que le point sur le chemin du premier transporteur (3) à partir duquel il est balayé se situe au point de transition entre les premier et deuxième transporteurs (3, 4) ou directement au voisinage de ce point.

8. Une méthode selon n'importe laquelle des revendications précédentes, caractérisée en ce que, quand la distance du bord avant du premier article et le bord avant du reste du groupe est déterminée et est inférieure à la première mesure prédéterminée, le premier transporteur (3) n'est pas arrêté ni ralenti par rapport au deuxième transporteur (4) tant que le bord avant du premier article se s'est pas déplacé de ladite première mesure prédéterminée, au-delà du point de transition entre les premier et deuxième transporteurs (3, 4).

9. Une méthode selon n'importe laquelle des revendications 1 à 7, caractérisée en ce que, quand la distance entre le bord avant du premier article et le bord avant du reste du groupe est déterminée et est plus importante que la première mesure prédéterminée, le premier transporteur (3) est arrêté ou ralenti par rapport au deuxième transporteur (4) dès que le bord avant du reste du groupe atteint le point de transition entra les premier et deuxième transporteurs (3, 4).

10. Une méthode selon n'importe quelle revendication précédente, caractérisée en ce que la distance entre le bord avant du premier article et le bord avant du reste du groupe est déterminée en mesurant la période de temps qui s'écoule entre les détections des bords avant par les moyens de détection d'articles (13, 14).

11. Une méthode selon n'importe quelle revendication précédente, caractérisée en ce que le

bord avant du premier article et le bord avant du reste du groupe sont détectés au point de transition entre les premier et deuxième transporteurs (3, 4) ou directement au voisinage de ce point.

12. Une méthode selon n'importe laquelle des revendications précédentes, caractérisée en ce qu'une différence de distance est introduite entre le bord avant d'un premier article qui se situe à la même hauteur que le bord avant d'un deuxième article en transportant les premier et deuxième articles jusqu'au dit premier transporteur amont fonctionnant indépendamment (3) par les moyens d'un troisième transporteur fonctionnant indépendamment, la direction de déplacement de celui étant transversale à celle dudit premier transporteur (3).

13. Un dispositif pour séparer le premier article d'un groupe d'articles de taille aléatoire présentés au hasard et qui sont transportés le long d'un système de transport qui comprend un premier transporteur amont pouvant fonctionner indépendamment (3), un deuxième transporteur aval pouvant fonctionner indépendamment (4), des moyens (8, 13, 14) pour déterminer la distance entre les bords avant et arrière d'un article ou d'un groupe d'articles et des moyens de commande sensibles à la sortie des moyens de détection des bords pour commander le fonctionnement des premier et deuxième transporteurs, caractérisés en ce qu'un premier moyen de détermination de distance (13, 14) détermine la distance entre le bord avant d'un premier article et le bord avant du reste du groupe d'articles quand le bord avant du reste du groupe d'articles se chevauche avec le bord arrière du premier article, associé à un premier moyen comparateur pour comparer ladite distance avec une première mesure prédéterminée de longueur égale en substance à la moitié de la longueur maximale attendue d'un article unique, et un deuxième moyen de détermination de distance (8) détermine la distance entre le bord avant et le bord arrière d'un article unique ou d'un groupe d'articles en cours de transport le long du premier transporteur (3), associé à un deuxième moyen comparateur pour comparer ladite distance avec une deuxième mesure prédéterminée de longueur égale à la longueur maximale attendue d'un article unique, et que les moyens de commande fonctionnent pour arrêter ou réduire la vitesse du premier transporteur (3) par rapport au deuxième transporteur (4) :

a) quand le bord avant d'un premier article, dont le bord arrière se chevauche avec le bord avant du reste du groupe, s'est avancé au delà du point de transition entre les premier et deuxième transporteur d'une distance qui est au moins égale à ladite première mesure prédéterminée de longueur déterminée par les premiers moyens de détermination de distance (13, 14) ; et,

b) quand il n'y a aucun chevauchement distinguable (tel a) ci-dessus) quand le bord avant d'un groupe d'articles s'est avancé au delà du point de transition entre les premier et deuxième transporteurs d'une distance qui est égale à la deuxième mesure prédéterminée de longueur déterminée par le deuxième moyen de détermination de distance (8).

14. Un dispositif selon la revendication 13, caractérisé en ce que les premiers moyens de détermination de distance (13, 14) comportent au moins deux détecteurs d'articles (13,14) positionnés côte à côte sur la largeur du dispositif, et un dispositif de chronométrage commandé par les sorties desdits au moins deux détecteurs d'articles (13, 14) pour déterminer la durée de temps écoulé entre la détection d'un article par un des détecteurs d'articles (13, 14) et la détection d'un article par l'autre détecteur d'articles (13,14).

15. Un dispositif selon la revendication 13 ou 14, caractérisée en ce que le deuxième moyen de détermination de distance (8) comporte un détecteur d'articles (8) qui balaie la largeur du premier transporteur (3) et un dispositif de chronométrage pour mesurer la durée de temps écoulée entre la détection du bord avant et du bord arrière d'un article unique ou d'un groupe d'articles qui passe devant le détecteur d'articles (8).

16. Un dispositif selon la revendication 15, caractérisé en ce que le dispositif de chronométrage est réglé pour ne pas tenir compte de changements de la sortie du détecteur d'articles (8) après la détection du premier bord avant, quand ceux-ci indiquent la détection d'un bord arrière et ensuite d'un deuxième bord avant qui ne se séparent pas l'un de l'autre d'une distance minimale requise pour séparer un premier article du reste du groupe.

17. Un dispositif selon les revendications 14, 15 ou 16, caractérisé en ce que le deuxième moyen de détermination de distance (8) est situé au point de transition entre le premier et deuxième transporteur (3, 4) ou directement au voisinage de ce point.

18. Un dispositif selon l'une quelconque des revendications 14 à 17, caractérisé en ce que les détecteurs d'articles comprennent chacun une cellule photoélectrique située en face d'une source de lumière.

19. Un dispositif selon l'une quelconque des revendications 13 à 18 caractérisé en ce que le dispositif comporte un transporteur supplémentaire pouvant fonctionner indépendamment et qui transporte des articles au premier transporteur, la direction de déplacement de celui-ci étant transversale à celle des premier et deuxième transporteurs.

20. Un dispositif selon la revendication 19, caractérisé en ce que le dispositif comprend un autre transporteur supplémentaire pouvant fonctionner indépendamment et qui transporte des articles venant du deuxième transporteur, la direction de déplacement de celui-ci étant transversale à celle des premier et deuxième transporteurs.

21. Un dispositif selon l'une quelconque des revendications 13 à 20, caractérisé en ce qu'un moyen supplémentaire de détection d'articles (12) est situé en aval du point de transition entre les premier et deuxième transporteurs (3,4), lequel moyen de détection d'articles (12) commande le retour à la vitesse normale de fonctionnement du premier transporteur (3).

22. Un dispositif selon la revendication 21, caractérisé en ce que le moyen de détection d'articles (12) balaie obliquement sur sa largeur le deuxième transporteur (4), provoquant ainsi un redémarrage différentiel du premier transporteur (3) selon la position de l'article sur la largeur du deuxième transporteur (4).

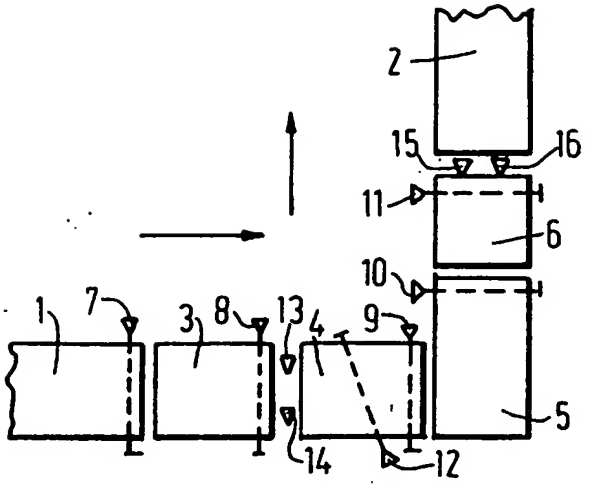

FIG.1

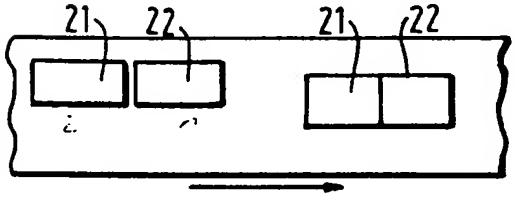

FIG.2a

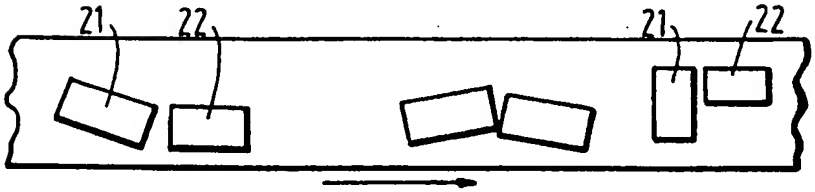

FIG.2b

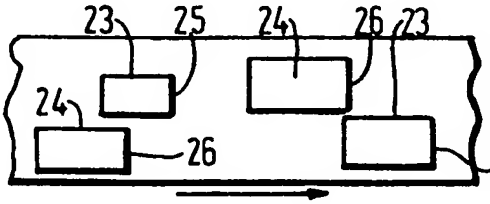

FIG.2c

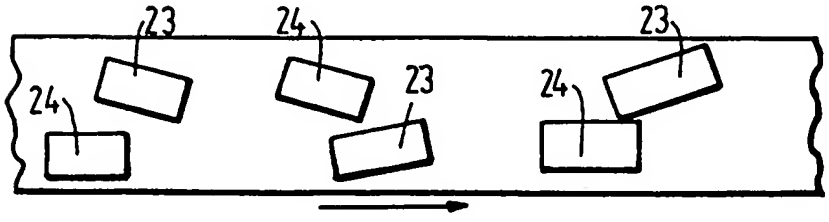

FIG.2d

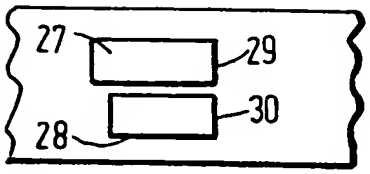

FIG.2e

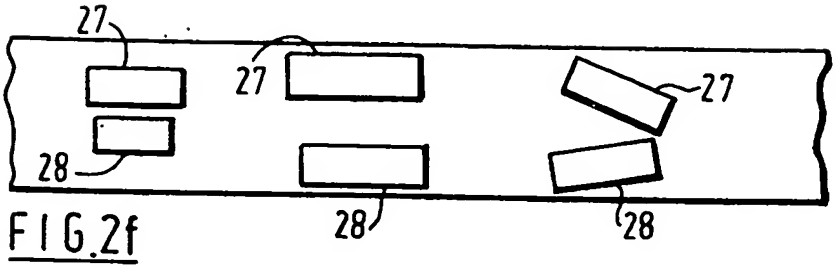

FIG.2f

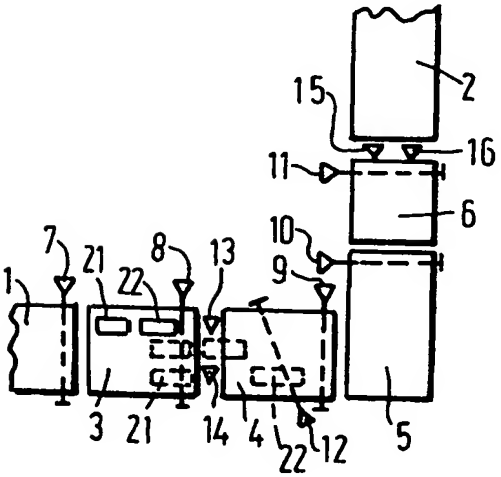

FIG.3a

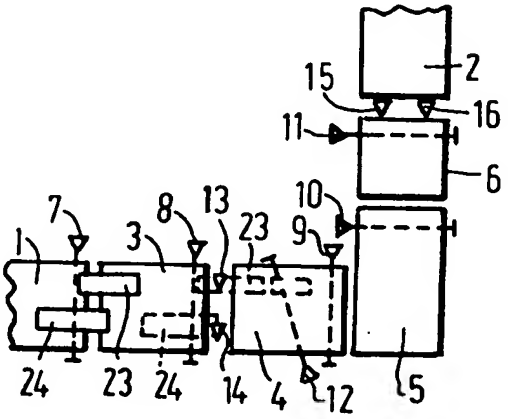

FIG.3b

FIG.3c